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ABSTRACT

The Matrix Analogies Test-Expanded Form (MAT-EF) and Kaufman Assessment Battery for Children (K-ABC) were administered in counterbalanced order to two randomly selected samples of students in grades 2 through 5. The MAT-EF was recently developed to measure non-verbal reasoning. The samples included 26 non-handicapped second graders in a rural midwest school district, and 25 school-identified gifted students (5 third graders, 10 fourth graders, and 10 fifth graders) attending a suburban midwest school district. Mean MAT-EF scores were lower than mean K-ABC scores for both samples. Significant correlations (corrected for range restriction) between MAT-EF and Mental Processing Composite (MPC) and Simultaneous Processing were obtained for both groups (0.53 and 0.49, respectively, for the non-handicapped group; and 0.53 and 0.42, respectively, for the gifted group). MAT-EF mean standard scores were approximately 0.5 standard deviation lower than MPC mean standard scores for both groups. Three tables are provided. (TJH)

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The Matrix Analogies Test: A Validity Study with the K-ABC

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Abstract

The MAT-EF and K-ABC were administered in counterbalanced order to two randomly selected samples: 26 nonhandicapped second graders in a rural, midwest school district and 25 school identified, gifted students (grades three through five) in a suburban, midwest school district. Significant correlations (corrected for range restriction) between MAT-EF and Mental Processing Composite and Simultaneous Processing were obtained for both groups (.53 and .49, respectively, for the nonhandicapped group and .53 and .42, respectively, for the gifted group). MAT-EF mean standard scores were approximately one-half standard deviation lower than MPC mean standard scores for both groups.

The Matrix Analogies Test-Expanded Form (MAT-EF; Naglieri, 1985) is a recently developed measure of nonverbal reasoning. The test uses 64 abstract designs of the standard progressive matrix type and provides a measure of "nonverbal ability with minimal motor involvement and minimal verbal comprehension requirements (Naglieri, 1985, p. 2). On the basis of factor analytic data, items were organized into four item groups: Pattern Completion (PC), Reasoning by Analogy (RA), Serial Reasoning (SR) and Spatial Visualization (SV).

Evidence for construct validity has been presented by relating scores on the MAT-EF with scores on the Multilevel Academic Survey Test (Naglieri, 1985). The relationship between the MAT-EF and other individually administered tests of intelligence has been investigated in a limited way. For example, the MAT-EF and the Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974) were administered to 82 nonhandicapped children in grades one through 11. Correlations with the WISC-R Full Scale IQ (FSIQ), Verbal Scale IQ (VIQ) and Performance Scale IQ (PIQ) were .52, .37 and .41 respectively (Naglieri, 1985). Differences in mean standard scores ranged from 8.2 (MAT-EF/VIQ) to 11.5 (MAT-EF/FSIQ) with MAT-EF scores lower. Additional studies relating MAT-EF performance with measures of nonverbal ability in nonhandicapped or gifted students are lacking.

Therefore, the purpose of the present research was to investigate the relationship between scores on the MAT-EF and the

Kaufman Assessment Battery for Children (K-ABC; A. Kaufman & N. Kaufman, 1983). The K-ABC was selected for this research since the role of verbal skills is minimized and nonverbal problem solving skills are measured through several subtests on the Simultaneous processing scale.

Method

Subjects

The present research utilized two randomly selected samples, one sample composed of 26 second grade students (13 males and 13 females) attending a primarily rural elementary school in the midwest. The students in this sample were all nonhandicapped, second graders who were neither receiving nor had been referred for special education services. The second sample consisted of 25 third through fifth grade, school identified gifted students (10 males and 15 females) attending a suburban elementary school in the midwest. Each student had been identified as gifted on the basis of creativity tests, intelligence tests, achievement tests and teacher/parent ratings. The K-ABC and MAT-EF were not used in the identification process. This sample was composed of five third graders, 10 fourth graders and 10 fifth graders. The parents of each child selected for the study were contacted and asked to participate. Participation rate was 87% for sample one and 100% for sample two.

Procedure

Each student was administered the K-ABC and MAT-EF in counterbalanced order by examiners trained in the administration and interpretation of both tests. The average length of time between test administrations was eight days with a range of five to 14 days.

Results and Discussion

Mean MAT-EF scores were somewhat lower than mean K-ABC scores for both samples. The difference ranged from 3.49 (MAT-EF/Achievement[ACH]) to 7.12 (MAT-EF/Simultaneous[SIM]) for the nonhandicapped sample and 5.88 (MAT-EF/SIM) to 9.28 (MAT-EF/Mental Processing Composite[MPC]) for the gifted sample. These results are similar to those reported by Naglieri (1985) in comparing the MAT-EF and WISC-R with a nonhandicapped sample. In that study the differences were described as being within normal limits based on the standard errors of measurement for both tests. Mean scores, standard deviations and minimum/maximum values by sample are reported in Table 1.

Insert Table 1 about here

In order to compare performance on the MAT-EF and K-ABC for each sample, Pearson product moment correlations were calculated. Due to the restricted range of scores, especially for the gifted sample, correlations were corrected using the procedure developed

by Guilford (1954). These correlations are reported in Tables 2 and 3.

Insert Table 2 about here

Insert Table 3 about here

For the second grade sample of nonhandicapped students significant correlations between the MAT-EF and K-ABC were indicated for MPC ($r = .53$, $p < .01$), SEQ ($r = .58$, $p < .01$) and SIM ($r = .49$, $p < .01$). The MAT-EF/ACH correlation of .16 was not significant. Correlations between the MAT-EF item groups and MPC, SEQ and SIM were all significant and ranged from .49 ($p < .01$) for PC/SEQ to .80 ($p < .001$) for RA/MPC. Moderate overlap between the MAT-EF and the K-ABC is indicated as 25% to 60% of the variance is explained by these correlations.

Significant correlations between the MAT-EF and K-ABC subtests were obtained for Hand Movements ($r = .45$, $p < .01$), Number Recall ($r = .52$, $p < .01$), Gestalt Closure ($r = .49$, $p < .01$), Photo Series ($r = .51$, $p < .01$) and Arithmetic ($r = .40$, $p < .05$). Interestingly, the MAT-EF correlation with the K-ABC Matrix Analogies subtest was not significant ($r = .24$). However, the correlation of each item group individually with the Matrix Analogies subtest was significant and ranged from .50 to .68. Item

groups, RA and SR, correlated significantly with all K-ABC mental processing subtests, while PC and SV each correlated significantly with five of the eight mental processing subtests. Correlations between the K-ABC Achievement subtests and the MAT-EF (and its four item groups) were largely confined to the Arithmetic subtest in which all correlations were significant ($r = .40$, $p < .05$ to $r = .82$, $p < .001$). In addition, significant correlations were obtained for PC/Riddles ($r = .58$, $p < .001$) and RA/Reading Decoding ($r = .53$, $p < .01$). These correlations are also supportive of the construct validity of the MAT-EF as the MAT-EF correlated at a higher level and more frequently with the cognitive subtests of the K-ABC rather than the Achievement subtests.

For the gifted sample, significant correlations between the MAT-EF and K-ABC were indicated for MPC ($r = .53$, $p < .01$) and SIM ($r = .42$, $p < .05$). The MAT-EF/SEQ and MAT-EF/ACH correlations of .17 and .13, respectively, were not significant. Correlations between the MAT-EF item groups and MPC, SEQ and SIM were limited with four of 12 correlations significant. Significant correlations between the MAT-EF and K-ABC subtests were obtained for Number Recall ($r = .46$, $p < .01$), Matrix Analogies ($r = .73$, $p < .001$), Photo Series ($r = .44$, $p < .01$), Faces and Places ($r = -.40$, $p < .01$), Arithmetic ($r = .53$, $p < .01$) and Reading Decoding ($r = .43$, $p < .01$). Item groups, PC and SR, each correlated significantly with four of the eight mental processing subtests, while RA correlated significantly with three mental processing subtests and

SV with two. Correlations between the K-ABC Achievement subtests and the MAT-EF (and its four item groups) were largely confined to the Arithmetic subtest in which four of the five correlations were significant ($r = .42$, $p < .01$ to $r = .62$, $p < .001$). Two significant negative correlations were indicated for Faces and Places with MAT-EF ($r = -.40$, $p < .05$) and with SV ($r = -.55$, $p < .01$). Significant correlations were obtained for MAT-EF/Reading Decoding ($r = .43$, $p > .01$) and SV/Reading Decoding ($r = .41$, $p < .05$).

The pattern of correlations obtained from the gifted sample is not as strong as for the second grade sample. In addition, the number of negative correlations, especially with Achievement subtests, was greater for the gifted sample. The correlation between the MAT-EF and MPC, however, was the same ($r = .53$) for both groups. The gifted sample was highly verbal, had higher achievement scores and was somewhat older than the second grade, nonhandicapped sample. Either or all of these factors may account for the differences in the magnitude of correlations.

Correlations of the four item groups with the MAT-EF total score were substantial for both groups. For each group, nine of the 10 correlations were significant. Thus, the structure of the MAT-EF is supported by these data which are consistent with research reported by Naglieri (1985)

A series of one-way analyses of variance were conducted on all global scales and subtests of the K-ABC and MAT-EF in order to

determine the presence of sex differences for each sample. Significant sex differences were indicated for Number Recall in the nonhandicapped sample ($F(1,24) = 6.83$, $p < .02$) with boys scoring significantly higher than girls and for total score on the MAT-EF in the gifted sample ($F(1,23) = 4.64$, $p < .04$) with girls scoring significantly higher than boys. With the large numbers of signficance tests conducted, these results may well represent chance findings and appear to be of little practical significance.

In summary, the present research adds support to the validity of the MAT-EF as a measure of nonverbal reasoning. Correlations with the K-ABC for both samples are moderate and consistent with the level of correlation between the MAT-EF and WISC-R obtained by Naglieri (1985). Differences in mean standard scores were indicated for both samples with the MAT-EF score approximately one half standard deviation lower than the MPC.

References

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Table 1

Means, Standard Deviations and Minimum/Maximum Values for the K-ABC and MAT-EF by Sample

Variable	Mean	Standard Deviation	Range
K-ABC			
MPC			
Sample 1	111.27	13.55	92-137
Sample 2	123.36	6.38	113-137
SIM			
Sample 1	111.31	13.90	89-137
Sample 2	119.96	8.06	101-139
SEQ			
Sample 1	107.77	10.73	85-131
Sample 2	120.64	7.79	98-135
ACH			
Sample 1	107.62	11.04	80-127
Sample 2	120.72	5.72	109-131
MAT-EF			
Sample 1	104.19	10.21	89-128
Sample 2	114.08	9.32	99-130

Note. Sample 1 consisted of 26 nonhandicapped, second grade students and Sample 2 consisted of 25 gifted, third through fifth grade students. MPC = Mental Processing Composite; SIM = Simultaneous Processing; SEQ = Sequential Processing; ACH = Achievement.

Table 2

Correlations between the K-ABC and the MAT-EF for the Second Grade Sample

	MAT-EF	PC	RA	SR	SV
K-ABC Scales					
MPC	.50(.53)**	.64(.75)*	.70(.80)*	.64(.68)*	.60(.78)*
SEQ	.45(.58)*	.37(.49)**	.57(.70)*	.68(.79)*	.54(.74)*
SIM	.46(.49)**	.69(.80)*	.68(.79)*	.55(.58)*	.56(.75)*
ACH	.12(.16)	.44(.56)*	.32(.41)***	.16(.22)	.26(.42)***
K-ABC Subtests					
HM	.37(.45)***	.38(.49)**	.54(.66)*	.67(.76)*	.25(.40)***
NR	.39(.52)**	.31(.43)***	.41(.54)**	.44(.57)**	.49(.68)*
WO	.27(.40)***	.15(.23)	.35(.51)**	.44(.61)*	.55(.74)*
GC	.39(.49)**	.48(.60)*	.61(.69)*	.33(.41)**	.27(.42)***
T	.30(.31)	.61(.70)*	.45(.56)**	.35(.36)***	.32(.50)**
MA	.22(.24)	.56(.68)*	.52(.64)*	.47(.50)**	.44(.58)*
SM	.26(.42)**	.29(.46)**	.37(.56)**	.46(.66)*	.46(.66)*
PS	.50(.51)**	.57(.69)*	.59(.71)*	.48(.50)**	.57(.76)*
F&P	.13(.24)	.17(.31)	.18(.33)	.05(.09)	.20(.36)***
A	.33(.40)**	.71(.82)*	.61(.72)*	.37(.44)**	.52(.71)*
R/D	-.01(-.02)	.22(.35)***	.36(.53)**	.17(.27)	.22(.35)***
R/U	-.03(-.04)	.26(.37)***	.25(.36)***	-.08(-.12)	.11(.18)

Note. Correlation coefficients reported in parentheses are corrected for restriction in range via Guilford's (1954) formula. MPC = Mental Processing Composite; SEQ = Sequential Processing; SIM = Simultaneous Processing; ACH = Achievement; HM = Hand Movements; NR = Number Recall; WO = Word Order; GC = Gestalt Closure; T = Triangles; MA = Matrix Analogies; SM = Spatial Memory; PS = Photo Series; F&P = Faces and Places; A = Arithmetic; R/D = Reading/Decoding; R/U = Reading/Understanding; PC = Pattern Completion; RA = Reasoning by Analogy; SR = Serial Reasoning; SV = Spatial Visualization.

n = 26

*p < .001

**p < .01

***p < .05

Table 3

Correlations between the K-ABC and the MAT-EF for the Gifted Sample

	MAT-EF	PC	RA	SR	SV
K-ABC Scales					
MPC	.26(.53)**	.23(.49)**	.28(.56)**	.04(.09)	.16(.36)***
SEQ	.09(.17)	.06(.12)	.17(.32)	-.13(-.24)	.05(.10)
SIM	.24(.42)***	.18(.33)	.20(.36)***	.15(.27)	.16(.29)
ACH	.05(.13)	.13(.32)	.24(.54)**	.04(.10)	.01(.03)
K-ABC Subtests					
HM	.06(.14)	-.04(-.10)	-.08(-.19)	-.21(-.46)**	.17(.40)***
NR	.31(.46)**	.37(.53)**	.39(.54)**	.13(.20)	.13(.19)
WO	-.24(-.37)	-.25(-.39)***	-.06(-.10)	-.25(-.39)***	-.21(-.33)
GC	-.01(-.02)	-.13(-.20)	.01(.02)	.00(.00)	.03(.04)
T	.05(.08)	.24(.37)	.14(.23)	-.12(-.20)	-.02(-.03)
MA	.38(.73)*	.39(.73)*	.43(.77)*	.21(.51)**	.27(.58)**
SM	.17(.26)	.03(.05)	-.07(-.10)	-.15(-.21)	.26(.33)
PS	.29(.44)**	.32(.48)**	.25(.38)***	.51(.69)*	.04(.06)
F&P	-.25(-.40)***	.13(.20)	.06(.10)	.08(.12)	-.36(-.55)**
A	.30(.53)**	.23(.42)**	.31(.54)**	.02(.04)	.37(.62)*
R	.00(.00)	.08(.17)	.22(.49)**	-.01(-.02)	-.03(-.06)
R/D	.25(.43)**	-.05(-.08)	.10(.16)	-.09(-.15)	.24(.41)***
R/U	-.09(-.16)	.03(.06)	.03(.06)	.03(.06)	-.08(-.14)

Note. Correlation coefficients reported in parentheses are corrected for restriction in range via Guilford's (1954) formula. MPC = Mental Processing Composite; SEQ = Sequential Processing; SIM = Simultaneous Processing; ACH = Achievement; HM = Hand Movements; NR = Number Recall; WO = Word Order; GC = Gestalt Closure; T = Triangles; MA = Matrix Analogies; SM = Spatial Memory; PS = Photo Series; F&P = Faces and Places; A = Arithmetic; R/D = Reading/Decoding; R/U = Reading/Understanding; PC = Pattern Completion; RA = Reasoning by Analogy; SR = Serial Reasoning; SV = Spatial Visualization.

n = 25

*p < .001

**p < .01

***p < .05